

## REPORT

# Brave New Genomes

Report on the BMBF-funded  
CRISPR.kitchen – Genome Hacking Retreat,  
13–17 March 2017, Munich, Germany

Harald König, *Institute for Technology Assessment and  
Systems Analysis (ITAS), Karlsruhe Institute of Technology,  
Karlsruhe, 76133 Karlsruhe (h.koenig@kit.edu)*

The arrival of the revolutionary CRISPR-Cas genome editing technique prompted scientific, ethical and societal controversy around possible gene editing applications, including inheritable changes to the human genome. International students, academic experts and biohackers from such diverse fields as art, biology, design, informatics or philosophy met to jointly imagine futures for the use of the CRISPR-Cas system, which may become increasingly accessible to non-institutional actors. By developing “fiction-in-science” scenarios they envisioned and explored opportunities as well as ethical, economic and social implications of potential genome editing applications.

The one week retreat (*Klausurwoche*), funded by the German Federal Ministry of Education and Research (BMBF), was organised by biohacker and researcher Rüdiger Trojok and hosted by the UnternehmerTUM at Technical University (TU) of Munich. The event brought together a group of 20 students, academic experts and biohackers from the fields of art, biochemistry, biology, design, economics, informatics, law, mathematics and philosophy – coming from several European countries, Japan and the U.S.A.

## Imagining genome editing applications

Participants were invited to develop proposals or ideas on non-obvious applications of genome editing or “genome hacking” that may arise from a democratised and decentral use of CRISPR-Cas genome editing. Following introductory lectures by the organisers on various aspects of genome editing, the proposals were presented by the participants and discussed during the first two days in order to provide food for thought on potential future applications, and to identify and discuss potential is-



Fig. 1: CRISPR.kitchen work impressions.

Source: [www.crispr.kitchen/](http://www.crispr.kitchen/), Karolina Sobecka

suues related to ethical, societal or regulatory aspects such applications might entail. The proposals encompassed ideas ranging from “sculpting living entities” in art, designed/edited human microbiomes (e. g., for improving health or reclaiming female reproductive technologies), to poultry gender control, inheritable genetic changes towards designer babies or designer grandchildren, to encoding human genomes within the DNA of trees to create “living memorials” (<http://www.crispr.kitchen/>).

Following this, four transdisciplinary teams were formed to develop four scenarios, taking into account ideas and discussions on issues and challenges that had come up so far. This group effort of scenario development was accompanied by lectures of invited experts from academia, industry and governmental authorities/organisations about bioethics, computer-based tools and opportunities for CRISPR-Cas/genome editing design, as well as genetic engineering regulation and intellectual property/patenting issues. Furthermore, the lecturers engaged extensively with the different groups, discussing aspects relevant for the nascent scenarios linked to their expertise, in order to foster iterative re-thinking and adaptations in the scenario development process.

## REPORT

# RRI in Germany: Reflections on the State of the Art

Report on the workshop “Responsible  
Research and Innovation in Practice”

Karlsruhe, 17 February 2017

Miltos Ladikas, *Institute for Technology Assessment  
and Systems Analysis (ITAS), Karlsruhe Institute of Technology,  
Karlsru. 11, 76133 Karlsruhe (miltos.ladikas@kit.edu)*  
Julia Hahn, Leonhard Hennen, Pavel Kulakov, Constanze Scherz,  
*Institute for Technology Assessment and Systems Analysis (ITAS),  
Karlsruhe Institute of Technology (KIT)*

85

## “Fiction-in-science” futures

The groups’ work led to four speculative, “fiction-in-science” scenarios: (i) the “Quantified Non-Self” (an extension of the idea of the quantified self) envisions comprehensive monitoring of individuals’ microbiomes and their editing to prevent disease conditions as well as to fight the global antibiotic crisis. The scenario proposes startling changes in the perception of our microbial environment and hygiene habits, and imagines changes of cultural practices. (ii) “Life Log: Gene Drive Defense” puts forward different monitor and control mechanisms to reduce potential risks and consequences of gene drives (genetic elements for the rapid, effective spreading of genetic changes in wild populations). (iii) “CRISPiRATES Nation” imagines a state in international waters in which all genome editing (including human germline engineering) is entirely legal and addresses associated ethical, social and political issues. (iv) “Conscious Aesthetics” presents as its theme a startup business selling wearable devices that induce packaged and pre-programmed feelings and sensations through CRISPR-mediated epigenetic changes, and brings up associated questions such as on addiction or the loss of control over oneself.

The scenarios as well as some kitchen-made laboratory devices (produced during the week) were presented in a public session on the afternoon of the last day. The audience included about 30 people mainly from the TU Munich campus, but also representatives of companies and Bavarian authorities in charge with GMO regulation, and journalists. The playful and imaginative, multimedia presentations of the scenarios, which also involved the audience with brief role plays in the case of the “CRISPiRATES Nation”, were able to spark various questions from and discussion with the audience, especially on ethical and social aspects related to possible genome editing applications.

## Conclusion

The event with its open exchange and collaboration between experts from within and outside academia led to the joint development of “fiction-in-science” type scenarios on genome editing futures. Even though, or maybe because, these scenarios were not primarily striving to be bound to truly realistic ideas (or what may appear as such), they were able to bring up some less obvious social, ethical and political issues – in addition to more classical ones linked to potential hazards from the environmental release of GMOs and their control/regulation. Among these less obvious points are ethical dilemmas (e. g., linked to enhanced individual competitiveness at the cost of losing self-control) and effects from possible changes in cultural practices and morals, arising from editing genomes and epigenomes in our environment and ourselves.

## Disclosure statement

The author declares that he was a co-applicant for the project grant “Genom-Hacking: Klausurwoche zu ethischen, rechtlichen und sozialen Aspekten moderner Verfahren der Genom-Editierung und deren möglicher Anwendung”, funded by the German Federal Ministry of Education and Research, BMBF (grant number 01GP1684), and that he serves as the project leader.

How do policy ideas from the European context influence national discourses? What questions arise for the stakeholders involved in each country? How are processes and practices adapted? In order to investigate this, a workshop on the state of the art of Responsible Research and Innovation (RRI) was held in Karlsruhe, as part of the EU-funded project “RRI-Practice”. The aim was to gather representatives from various organisations and areas in order to gain insights into the diverse discussions and developments regarding responsibility in the context of science and innovation.

Responsible Research and Innovation (RRI) is a concept promoted by the European Commission as a science policy framework that seeks to align technological innovation with broader social values and support institutional decisions concerning the goals and trajectories of research and innovation under conditions of uncertainty, ambiguity and ignorance (Stilgoe et al. 2013). RRI is certainly based on Technology Assessment (TA) processes and methodologies, while attempting to be more inclusive in S & T issues under discussion (Hahn and Ladikas 2014). It is still under discussion whether RRI fits the various national S & T structures and, if yes, how. In order to discuss these questions from different points of view, participants came from various organisations representing the research landscape in Germany, including large-scale research funding and conducting organisations (Helmholtz

This is an article distributed under the terms of the Creative Commons Attribution License CCBY 4.0 (<https://creativecommons.org/licenses/by/4.0/>)  
<https://doi.org/10.14512/tatup.26.1-2.85>